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The American Fertilizer

Vol. 99 NOVEMBER 20, 1943 No. 11

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AMERICAN FERTILIZER

"That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

Vol. 99 NOVEMBER 20, 1943 No. 11

Phosphate Fixation in Soils*

By E. G. WILLIAMS, The Macaulay Institute for Soil Research

IT HAS long been known that, while considerable amounts of nitrogen and lime together with small amounts of potash are washed out of soils in the drainage waters, the loss of phosphate is always extremely small. This is so even where heavy dressings of water-soluble phosphate such as superphosphate have been added. In fact, the phosphate added to most soils moves downwards very slowly indeed. In cultivated soils there is generally very little penetration beyond the cultivated layer, while in grassland the phosphate often fails to penetrate more than about two inches. The reason for this is that easily dissolved forms of phosphate, when added to soils, are changed into forms which are more difficult to dissolve, and in view of what has been said above it is not surprising that this change is known as "phosphate fixation." Thus, phosphate fixation in soils means the conversion of soluble forms of phosphate into less soluble forms, and from the practical point of view it has very important consequences.

Practical Importance

This lies in the fact that fixation prevents full use being made of phosphate fertilizers. This happens in two ways:

1. *Decrease in availability.* Plants obtain most of their phosphate from the more soluble forms present in soils. These constitute most of what is called the "available" phosphate, which is always only a small fraction of the total amount present. Some of the forms in which phosphate is fixed are so difficultly soluble that they are for practical purposes unavailable, i.e., of very little use to plants. In ordinary soils it is generally the case that only about 20 per cent of the phosphate added is recovered in the crops before it becomes necessary to add more in order to keep up the yields. If no more were added, some of the remainder would be slowly recovered, but at the price of much lower yields. From the farmer's point of view a great deal of the phosphate added is just locked up in the soil.

2. *Decrease in penetration.* If the phosphate does not penetrate to where the roots are most active, plants cannot make full use of it. In this way, fixation often reduces greatly the efficiency of phosphate fertilizers, especially where, as on grassland, they are broadcast on the surface and not cultivated in.

In view of the great practical importance of fixation it is very desirable to know something about the ways in which it takes place in different soils and under different conditions. In fact, this is necessary before steps can be taken to reduce its undesirable effects and improve the efficiency of phosphate fertilizers.

Types of Fixation

There are two main types, viz.: Biological Fixation and Chemical Fixation, which take place as follows:

1. *Biological fixation.* This is brought about by certain bacteria which build phosphate into their bodies. In this way, inorganic forms of phosphate, such as superphosphate, are converted into organic forms which may be regarded as belonging to the organic matter of the soil. These organic forms of phosphate are of no direct value to plants. Some of them, however, are slowly converted back into inorganic form by other bacteria and in other ways, and may thus become available again to some extent.

*Reprinted from "The Scottish Journal of Agriculture."

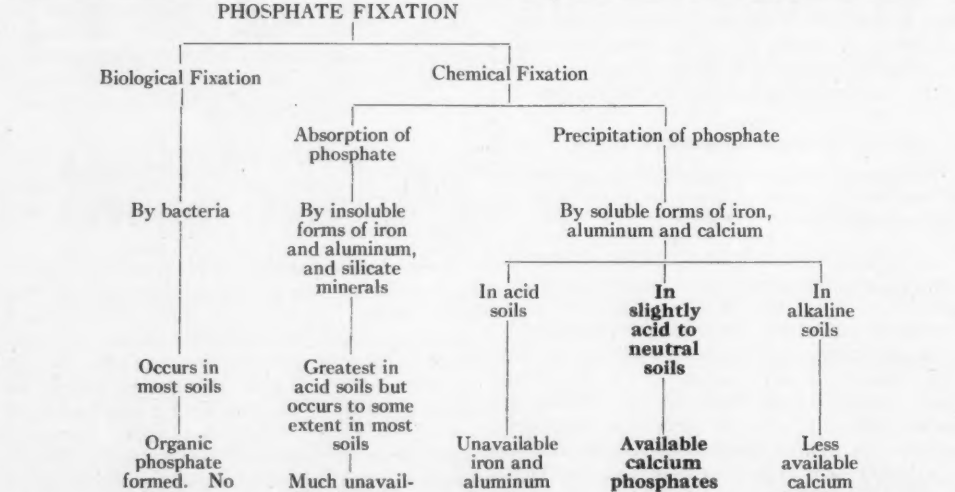
2. *Chemical fixation.* This is the more important type and is largely brought about by the mineral portion of the soil. It takes place in two main ways:

(a) *By absorption.* Certain insoluble forms of iron and aluminum, together with certain silicate minerals present in the clay portions of soils, absorb dissolved phosphate from the soil water. This type of fixation is very widespread, especially in heavy soils, and is greatest under acid conditions. Heavy, acid soils can fix very large amounts of phosphate in a very unavailable state. The absorbed phosphate slowly undergoes further changes, giving rise to even more insoluble mineral phosphates of iron and aluminum which are about the most unavailable forms of phosphate found in soils. This type of fixation is somewhat analogous to the taking up of water by a sponge. When only a small amount of water is added to a dry sponge, it is held very tightly, but as more water is added it becomes less tightly held and more easily squeezed out. In a like manner, the reserve of phosphate in the soil must be built up to a certain extent before the phosphate becomes available, and until this has been done very little benefit will be obtained from any soluble phosphate added. This point is of the utmost practical importance.

(b) *By precipitation.* This type of chemical fixation differs from the one just described in that the substances which cause it are themselves soluble. It is chiefly brought about by soluble forms of iron, aluminum and calcium. When these are present in solution in the soil water and a soluble phosphate such as superphosphate is added, they unite chemically with it to form relatively insoluble phosphate compounds. These are deposited in solid form in the soil, and the deposition of solids in this manner is called precipitation. This type of fixation thus consists of the precipitation of relatively insoluble phosphates of iron, aluminum and calcium, which are of varying value to plants. The extent to which these different phosphates are precipitated depends very much on whether the soil is acid or not. The main tendencies are as follows:

(i.) *In acid soils.* Fixation is mainly in the form of iron and aluminum phosphates which are least soluble and most readily formed under acid conditions. In the newly precipitated state they are of some use to plants, especially if the soil is not very acid. With time, however, they undergo further changes, to give extremely unavailable mineral phosphates, and, generally speaking, the iron and aluminum phosphates of soils are of little use to plants.

(ii.) *In slightly acid to neutral soils.* Fixation is mainly in the form of calcium phosphates. Iron and aluminum phosphates are also formed to some extent and if there are soluble forms of manganese present, some manganese phosphate may be precipitated as well. The calcium phosphates formed under these conditions are about the most available forms of fixed phosphate that exist in soils. In time, however, they, too, are liable to become converted into a very unavailable form, in this case a mineral phosphate called apatite.


PHOSPHATE FIXATION
Biological Fixation
Chemical Fixation
Absorption of phosphate
Precipitation of phosphate
By bacteria
By insoluble forms of iron and aluminum, and silicate minerals
By soluble forms of iron, aluminum and calcium
In acid soils
In slightly acid to neutral soils
In alkaline soils
Occurs in most soils
Greatest in acid soils but occurs to some extent in most soils
Organic phosphate formed. No direct use to crops.
Much unavailable phosphate formed.
Unavailable iron and aluminum phosphates formed.
Available calcium phosphates formed.
Less available calcium phosphates formed.

(iii.) *In alkaline soils.* Fixation is again mainly in the form of calcium phosphates, but of a more insoluble and less available type. The unavailable mineral phosphate, apatite, is quite common in alkaline soils. There is no precipitation of iron and aluminum phosphates as such, because these are soluble under alkaline conditions. Magnesium phosphates, however, are rather insoluble in alkaline soils and are precipitated to varying extents, but these are usually quite available forms.

Such, briefly, are the main ways in which fixation takes place. These are summarized in the accompanying diagram from which it will be seen that fixation of phosphate in forms unavailable to plants is least in slightly acid to neutral soils.

Ways of Combating Fixation and Increasing the Efficiency of Phosphate Fertilizers

There are several measures which can be adopted in practice. These can be summarized under the following heads: (1) maintaining favorable soil conditions; (2) using suitable forms of phosphate; (3) using efficient methods of applying phosphate.

(1) *Maintaining favorable soil conditions.* In practice this amounts to liming acid soils and maintaining general fertility.

(a) *Liming acid soils.* Adequate liming of acid soils is of paramount importance. It has several very desirable effects.

(i.) It reduces the amount of phosphate fixed in unavailable forms by decreasing the acidity and causing precipitation of available calcium phosphates. As already emphasized, fixation in unavailable forms is least under slightly acid to neutral conditions. Liming also helps to keep the very minute particles of clay bound together in granular form, making it still more difficult for them to fix phosphate. This is particularly important in heavy soils. There is plenty of direct evidence from field experiments that water-soluble phosphate fertilizers such as superphosphate are not only much more effective but remain so for a longer time when the soil has been properly limed. The lime is most effective when allowed to become thoroughly incorporated in the soil before phosphate is applied. Any form of lime will do, provided the right amount is used. A soil test will tell how much is needed. Over-liming can be just as harmful as under-liming and should be avoided.

(ii.) Liming releases some of the unavailable phosphate present in soils, especially if they have been receiving heavy dressings of phosphate in the past. In particular, liming helps to break down the organic forms of phosphate which as already mentioned, are of no direct value to plants. Infertile acid soils are particularly rich in organic phosphate, which often amounts to half the total phosphate. In some soils, liming may, for a while, do away with the need for phosphate. It should not, however, be regarded as a substitute because continual liming without adding any phosphate soon depletes the reserves of phosphate in the soil.

(iii.) Liming acid soils until they are just slightly acid not only helps to insure an adequate supply of available phosphate, it also makes it easy for plants to take it up. If the soil is too acid or too alkaline, plants cannot take up enough phosphate to meet their needs, even when there is plenty actually dissolved in the soil water. They take up phosphate best under slightly acid to neutral conditions.

(iv.) In well-limed soils, soluble salts such as muriate of potash and sulphate of ammonia tend to increase phosphate availability. In acid soils, on the other hand, they tend to make the iron and aluminum compounds of the soil more active and may cause increased fixation in unavailable form.

Adequate liming has, of course, several other very beneficial general effects on soils, but from the point of view of phosphate availability alone its importance cannot be over-emphasized.

(b) *Maintaining general fertility.* The presence of adequate supplies of phosphate in the soil is a factor of the greatest importance in the development of plant roots, but plants cannot make full use of the phosphate supplied to them unless other soil conditions are also favorable. In order to develop properly and work efficiently, roots must have an adequate supply of other nutrients, air, and water. Any treatment of the soil, such as manuring, conserving the organic matter, draining, and cultivating, which helps to maintain general fertility, promotes efficient utilization of the available phosphate. Although organic phosphates as such are not taken up by plants, well-humified organic matter is beneficial in maintaining general fertility and has an additional direct effect on phosphate availability in that it can unite with certain forms of iron and aluminum making them less able to fix phosphate.

(2) *Using suitable forms of phosphate.*

Soluble phosphates. Water-soluble forms of phosphate such as superphosphate are of the greatest value as fertilizers. Being water-soluble, however, not only are they readily taken up by plants, they are also rapidly fixed. In a way it may be said that they dissolve

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State Goals Meetings Pledge Record 1944 Production

American farmers, in a series of State meetings just ended, set for themselves a 1944 goal, which, if reached, will be a new all-time agricultural production record. The totals arrived at are as encouraging as the actual farm production record made in 1943, the War Food Administration reports. They indicate that, barring the unforeseen, the nation's farmers will again meet the nation's heavy wartime requirements for food, fats, and fibers.

Item	1943 Indicated	1944 Goal
	1,000 Acres	
Grain and Hay	293,646	307,724
Corn, planted	96,818	100,253
Oats, planted	42,654	39,558
Barley, planted	17,893	17,372
Sorghum (except sirup), planted	17,220	16,740
Hay, all tame, harvested	60,489	62,838
Wheat, planted	54,159	67,030
Rye, acreage for harvest as grain	2,875	2,408
Rice, planted	1,538	1,525
Oil and Fiber Crops	45,041	48,423
Soybeans, harvested for beans	11,480	13,654
Flaxseed, planted	6,289	5,895
Peanuts, grown alone	5,013	6,158
Cotton (in cultivation July 1)	21,995	22,277
Flax, for fiber	15	25
Broom corn, planted	249	414
Sugar Crops	967	1,284
Sugar beet, planted	636	951
Sugar cane, for sugar and seed	331	333
Vegetables	7,997	8,473
Irish potatoes, planted	3,444	3,519
Sweet potatoes, planted	923	1,056
Fresh vegetables, 23 crops	1,524	1,688
Processing vegetables, 11 crops	2,106	2,210
Other Crops	[1]	10,951
Dry beans, planted	2,807	3,048
Dry peas, planted	741	895
Tobacco, planted	1,471	1,756[2]
Winter cover crop seed:		
Hairy vetch	93	80
Common vetch	32	40
Purple vetch	21	24
Austrian winter peas	152	67
Crimson clover	54	66
Ryegrass, common	60	85
Hay crop seeds:		
Red clover	[1]	1,781
Sweet clover	[1]	400
Timothy	[1]	394
Alfalfa	[1]	1,070
Alsike	[1]	217
Lespedeza	[1]	1,028
Total land devoted to crops[3]	363,694	380,000

[1]Not available. [2]The acreage of tobacco shown for 1944 includes marketing quota allotments for Burley and flue-cured that may not be fully planted. [3]Excludes estimated acreage duplication where the same crop is used for two purposes, and includes miscellaneous crops not listed in the table.

Acreage goals for 1944 have been established for all of the principal crops. Achievement of the goals will require using about 380 million acres for crops in 1944, compared with about 364 million acres in 1943.

In setting the goals for 1944, farmers made it clear that they would need adequate machinery, fertilizer, and labor and that it would be necessary to have a continuation of the present price supports, and in some cases increased price supports.

In announcing the results of the State meetings, War Food Administrator Marvin Jones said: "It is extremely gratifying to note that the farmers of this country, acting on a purely voluntary basis, have set goals that exceed those for the banner production years of 1942 and 1943. Their action reflects a fine spirit and a determination to do whatever is necessary to produce the food needed for winning the war."

Plowing Under Fertilizer Gets Results*

Remember that old statement that you once heard almost every day, "If you fertilize and don't get plenty of rain, you'll burn up"? If that theory hasn't already been thoroughly discredited, then Roscoe Stitt, Warrick Co., Ind., is certainly doing it.

For years Roscoe has been using almost unheard of amounts of fertilizer in his pasture improvement program which has kept his pastures green and vigorous during drouths that burned most pastures to a crisp. Not content with the old methods of applying commercial fertilizers on or near the surface, he has purchased and is now using a breaking plow fertilizer attachment that deposits a stream of fertilizer in the bottom of the furrow as the soil is turned. Roscoe believes that this attachment, of which only a few have been manufactured and put into use, is destined to become almost a necessity on farms in the Middle West.

The agronomy departments of many agricultural colleges have carried on experiments with placing a band of fertilizer of the proper proportions on the plow sole. Even though this is his first year to use this attachment, Roscoe says that his experience of the past few years when he used the old method of

(Continued on page 18)

*Reprinted from "Prairie Farmer."

Revision of Fertilizer Order

Changes in WFA Regulations Simplify Procedure. Some New Grades Added. Extra Fertilizer Allowed for Some Group B Crops.

(*Contined from the November 6th issue*)

(g) *Distribution and delivery.* (1) Each fertilizer manufacturer, dealer and agent shall during the 1943–1944 season make fertilizer available according to crop requirements in each geographical locality in which such manufacturer, dealer and agent made fertilizer available for use in the 1942–1943 season, unless such manufacturer, dealer or agent, has adequate proof that the crop requirements for fertilizer in any such locality are being adequately served by other manufacturers, dealers or agents. For the purposes of this paragraph, no account shall be taken of fertilizer delivered in the 1942–1943 season outside of the regular geographical localities served by a manufacturer, dealer, or agent, where such deliveries were made at the specific request of the War Food Administration or its predecessors.

(2) No fertilizer manufacturer, dealer or agent shall deliver fertilizer to any person in excess of such person's requirements, as provided for in paragraph (h) hereof, and no person shall use any fertilizer in excess of his requirements as provided for in paragraph (h) hereof. This paragraph (g) (2) shall not apply to delivery or use of fertilizer pursuant to paragraph (d) (2) (v) hereof.

(3) Fertilizer manufacturers, dealers and agents shall accept applications and make deliveries of fertilizers for use on Group A crops before delivering fertilizers for use on Group B crops requiring fertilizers at the same time, but applications for fertilizer for Group A crops shall be made at least 30 days in advance of the date such fertilizer is required in order to obtain preference over applications for fertilizer for Group B crops requiring fertilizer at the same time. Fertilizer manufacturers, dealers and agents shall accept applications for Production-Increment crops at any time. Deliveries of such Production-Increment fertilizers shall be made in accordance with the provisions of paragraph (h) (3) of this order or in accordance with directions issued by the Director. Deliveries of mixed fertilizers and materials for Group A and Group B crop requirements shall, in all cases, receive priority over deliveries of Production-Increment fertilizer for Production-Increment crops.

(4) In accepting applications for and making deliveries of fertilizer materials, no fertilizer manufacturer, dealer or agent shall discriminate against persons who apply for such materials for home mixing: *Provided, however,* That the requirements of such persons shall be established in accordance with the provisions of paragraph (g) hereof, and that the amount of such available materials delivered to any person for home mixing shall not exceed the amount which such person would be eligible to obtain in mixed fertilizers pursuant to the provisions of this order.

Crops Classified

(h) *Requirements*—(1) *Group A crops.* The requirement of any person for fertilizer for use on any Group A crop shall be the acreage of the crop to be grown by such person multiplied either by the rate of application per acre customarily used by such person for such crop, or customarily used on comparable farms in the same area for such crop, or by the rate of application per acre recommended by the State Agricultural Experiment Station for such crop in the same area: *Provided, however,* That in no case, except as provided in paragraph (h) (4) hereof, shall the rate of application per acre exceed the rate of application per acre recommended by the State Agricultural Experiment Station for such crop in such area.

(2) *Group B crops.* The requirement of any person for fertilizer for use on any Group B crop shall be the acreage of the crop to be grown for which fertilizer is requested by such person multiplied by the rate of application per acre customarily used by such person on such crop, or customarily used on such crop on the farm for which fertilizer is being requested, or customarily used on such crop on comparable farms in the same area: *Provided, however,* That in no case, except as provided in paragraph (h) (4) hereof, shall the rate of application per acre exceed the rate of application per acre recommended by the State Agricultural Experiment Station for use on such Group B crop.

(3) *Production-Increment crops.* The requirement of any person for Production-Increment fertilizer shall, for use on any Produc-

tion-Increment crop in any area, be the acreage of the crop to be grown for which fertilizer is requested by such person multiplied by a rate of application per acre, not exceeding the maximum rate of application per acre recommended by the State Agricultural Experiment Station for use on such crop in such area.

(4) Notwithstanding the foregoing provisions of paragraph (h) hereof, the Director may fix the maximum rate of application per acre for use on any crop, and in connection therewith may, in his discretion, fix the maximum pounds of any individual fertilizer component to be applied per acre.

Forms of Application

(i) *Applications.* (1) No fertilizer manufacturer, dealer or agent shall, in the year ending June 30, 1944, deliver to any person any fertilizer for use by such person on crops (except fertilizer delivered pursuant to (b) (2), (c) (2), (d) (1) (i), (d) (2) (ii), (d) (2) (iii), (d) (2) (iv), and (d) (2) (v) hereof), unless prior to such delivery he shall have received from the person to whom delivery is to be made for use (hereinafter referred to as the applicant) a written application therefor. An application may cover all or any part of the applicant's fertilizer requirements for the year ending June 30, 1944. Another application shall be made in any case where the actual acreage to be planted is greater than the acreage included in the original application or where fertilizer is required for crops of acreages not already covered by an application. Each application shall contain the following:

(i) The fertilizer requirements covered by the application, by crops, acreage of crops, grades of mixed fertilizers or materials, rates of application (pounds of fertilizer) per acre, and quantities required.

(ii) A statement that the applicant has no fertilizer on hand, or ordered, to apply on such requirements.

(iii) A certification to the effect that the information used to establish the applicant's requirements for the crops indicated on the application is correct, and that his fertilizer requirements for any crop or acreage not stated thereon will be covered by another application.

(iv) The signature and address of the applicant, the date of signing the application, and the name of the dealer, agent, or manufacturer, to whom the application is given.

(2) Each fertilizer manufacturer shall provide a sufficient quantity of application forms for his own use and the use of his agents and dealers, on which the information required by paragraph (i) (1) hereof shall be written. Each fertilizer manufacturer may, if he wishes, print his firm's name and address on the form. He may also, if he wishes, use a combined application and order form to provide for including, in addition to the information required by paragraph (i) (1) hereof, such information (as bag sizes and kinds, prices and terms of sale) as may be necessary for such order purposes and a record of deliveries, using the face and reverse side. The applications shall be signed in duplicate, one of the copies to be given to the applicant and the other to be retained by the manufacturer or his dealer or agent.

(3) No fertilizer manufacturer, dealer, or agent shall use on his own crops any fertilizer (except fertilizer used pursuant to paragraphs (b) (2), (c) (2), (d) (1) (i), (d) (2) (i), and (d) (2) (ii) hereof), unless he has executed the form of application provided for in paragraph (i) (2) hereof. (The provisions of paragraphs (i) (1), (i) (2), and (i) (3) hereof have been approved by the Bureau of the Budget in accordance with the Federal Reports Act of 1942.)

Records and Reports

(j) *Records.* Each fertilizer manufacturer, dealer or agent, who delivers any fertilizer to any person other than a fertilizer manufacturer, dealer, or agent (or uses any fertilizer on his own crops) shall keep a record of each such delivery, showing the person to whom delivery is made, the date of delivery, and the quantity of fertilizer materials or grade of mixed fertilizer (and a similar record of use on his own crops), and each such manufacturer, dealer, or agent shall retain for not less than two years, such records and all applications accepted by him pursuant to paragraph (i) (1) hereof: *Provided, however,* That the provisions of this paragraph (j) shall not apply to individual deliveries in lots of less than 250 pounds of fertilizer authorized to be delivered by paragraphs (b) (2), (c) (2), (d) (1) (i), and (d) (2) (ii) hereof. (The record keeping requirements of this paragraph have been approved by the Bureau of the Budget in accordance with the Federal Reports Act of 1942.)

(k) *Reports.* Each person affected by this order shall make such reports to the Director in such form and at such time as the Director may from time to time request, subject to the approval of the Bureau of the Budget in accordance with the Federal Reports Act of 1942.

(l) *State regulations.* Nothing contained in this order shall be construed to permit the delivery or use of any grade of fertilizer in any State where the use or delivery of such grade in such State is specifically prohibited by such State.

(m) *Notification of customers.* Fertilizer manufacturers, dealers and agents shall, as soon as practicable, notify each of their regular customers of the requirements of this order, but failure to give or receive such notice shall not excuse any person from complying with the terms hereof.

(n) *Audits and inspections.* Each fertilizer manufacturer, dealer or agent to whom this order applies shall, upon request, submit his books, records, and accounts, for audit and inspection by duly authorized representatives of the War Food Administration.

(o) *Violations.* Any person who wilfully violates any provision of this order, or who, in connection with this order, wilfully conceals a material fact or furnishes false information to any department or agency of the United States, or who conspires with another to perform any of such acts, is guilty of a crime and upon conviction may be punished by fine and imprisonment. In addition, any such person may by administrative suspension order be prohibited from receiving any deliveries of or selling or otherwise disposing of or using any fertilizer or any other material now or hereafter authorized to be rationed or allocated by, or subject to the priority control of the War Food Administrator, and may be deprived of any priority assistance. Further, the Director may recommend to the Office of Price Administration or to the War Production Board that any person who violates any provision of this order or any amendment or supplement thereto be denied the right to receive, use, sell or otherwise dispose of any other materials which now are or in the future may be under allocation.

(p) *Petition for relief from hardship.* Any person affected by this order who considers that compliance herewith would work an exceptional and unreasonable hardship on him may apply in writing for relief to the Director, setting forth in such petition all pertinent facts and information. The Director may, upon the basis of such application and other information, take such action as he deems appropriate. The decision of the Director shall be in writing and shall be final and conclusive.

(q) *Delegation of authority.* The administration of this Food Production Order No. 5, Revised, and the powers conferred upon the War Food Administrator by Executive Order No. 9280 and Executive Order No. 9322, as amended by Executive Order No. 9334, insofar as such powers relate to the administration of this order are hereby delegated to the Director. The Director shall be assisted in the administration of this order by such employees of the War Food Administration as he may designate, and such employees are hereby authorized to administer the provisions of this order.

(r) *Communications.* All reports required to be filed hereunder and all communications concerning this order shall, unless instructions to the contrary are issued, be addressed to the Office of Materials and Facilities, War Food Administration, Washington 25, D. C., Ref.: FPO-5.

(s) *Effect on War Production Board Order M-231.* War Production Board Order M-231 is superseded by this Food Production Order No. 5, Revision 2: *Provided, however,* That War Production Board Order M-231 shall continue to remain in full force and effect for the purpose of allowing or sustaining any suit, action, prosecution, or administrative or other proceeding heretofore or hereafter commenced with respect to any violation committed or right or liability incurred prior to January 18, 1943, under or pursuant to the terms of War Production Board Order M-231.

Schedule I—Fertilizer Grades for 1943-1944
Grades Applicable to All States

Nitrate of soda	16–0–0[1]
Byproduct nitrate of soda	14–0–0
Nitrate of potash	14–0–14
Sulphate of ammonia	20 (or higher)–0–0
Cyanamid	20 (or higher)–0–0
Uramon	42–0–0
Ammoniated superphosphate	4 (or higher)–16 (or higher)–0
Ammoniated superphosphate	4–12 (or higher)–0
Ammonium phosphate	11–48–0 16–20–0
Uramon-limestone	20 (or higher)–0–0
Ammonium nitrate-limestone	20 (or higher)–0–0
Ammonium nitrate	30 (or higher)–0–0[1]
Potassium nitrate	14–0–44 (or higher)
Superphosphate	0–18 (or higher)–0[1]
Muriate of potash	0–0–50 (or higher)
Sulphate of potash	0–0–48 (or higher)
Manure salts	0–0–22 (or higher)
Sulphate of potash magnesia	0–0–18 (or higher)
Potash lime	0–0–6
Ground phosphate rock	Any Grade
Colloidal phosphate	Any Grade
Cotton hull ash	Any Grade
Wood ash	Any Grade
Straight carriers of organic nitrogen	Any Grade[1]

[1]This grade is designated for use on victory gardens in conformity with the provisions of paragraphs (b) (2) and (b) (4), but is not limited to such use.

(Continued on page 24)

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PIONEER JOURNAL OF THE FERTILIZER INDUSTRY

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Lend-Lease Potash Shipments to Be Restricted

Unless specifically instructed to do otherwise by War Food Administrator Marvin Jones, the Chemicals and Fertilizer Branch of the War Food Administration will make no further supplies of potash available to the United Kingdom in spite of the understanding reached earlier this year by the Combined Food Board that the U. K. was to obtain 60,000 tons from this country.

Testifying at hearings November 8th before the subcommittee of the senate committee on agriculture investigating the fertilizer situation, Phillip H. Groggins, chief of the branch, made it plain that he entertained grave doubts that the potash supply situation was being handled in its most efficient manner and had instructed his staff to halt further shipments to the U. K.

Up to the present time about 30,000 tons, equal to 18,000 tons K_2O, have been shipped to Britain. This is just about one-half of the amount that had been set aside under the Combined Food Board order, and has been allocated to the U. K. by the Chemicals Division of the War Production Board on a piece meal basis on orders from WFA.

In addition to this 60,000 tons, Great Britain also was scheduled to receive about 36,000 tons from Spain. Latest information is that the U. K. is encountering some difficulty in obtaining this potash which has led Mr. Groggins at least to feel that this situation is not being properly met and firmer action should be taken to make certain that the U. K. gets the Spanish supply. He said to the committee: "I think we can afford to be rough with the Franco government and have them increase the rate of production to fulfill the U. K. requirements."

Senator Alen J. Ellender of Louisiana, chairman of the investigating subcommittee, said that there have been charges made that potash has been sent to the United Kingdom under lend-lease at a time when we need the potash here and while there were ample supplies in other sources to meet U. K. needs.

Dale Kieffer, chief of the Fertilizer Materials Unit, WPB, said that the U. K. has been attempting to get potash from Russia, but he knew of no shipments from Russia to Britain in the last six months. U. K. requirements for potash, he stated, amount to 122,000 tons of K_2O, of which 56,000 tons were to come from Palestine, 36,000 tons from Spain,

and the United States was to underwrite the remainder.

Senator Ellender asked why the U. K. requirements were not filled with North African potash instead of coming to the United States. The charge has been made, he said, that Britain comes to us because it can get it for nothing.

Richard M. Bissell of the War Shipping Administration said that he understood that Britain was taking all of the phosphate from North Africa that it could acquire, but there was not enough there, from a physical handling standpoint, to meet the needs of the increased U. K. food program.

Use of Organic Nitrogen Restricted

The War Food Administration has announced measures designed to make all forms of organic nitrogen materials available to eligible users in as equitable a manner as possible during the 1943–44 crop season. Food production order No. 12, revision 2, provides for the distribution of a limited quantity of edible cottonseed meal for use in fertilizer. In general the order sets up eligibility standards for purchasers of edible cottonseed meal for use in fertilizer.

Under the terms of the order, the amount of organic nitrogenous materials which manufacturers and certain types of buyers can acquire, in terms of actual nitrogen units, is limited to 70 per cent of the amount they used in mixed fertilizers for application to crops in the fiscal year 1941–42. This restriction applies to all organic nitrogenous materials, including the limited amount of edible type seed meal which manufacturers may become eligible to purchase during the current fertilizer year. In order to become eligible to purchase the edible seed meal, manufacturers must file an application with the director of the Office of Materials and Facilities, War Food Administration. Applications are not required for other types of organic nitrogen materials.

According to the standards of eligibility, a user of fertilizer containing all organic nitrogenous materials covered by FPO No. 12, as revised, may buy up to 70 per cent of his 1941–42 purchases. However, since the amount of edible meal is limited more than other materials an eligible purchaser will be able to buy from processors or jobbers a portion smaller than 70 per cent of the actual edible type of seed meals he used as fertilizer in 1941–42.

New Price Ceilings on Mixed Fertilizer, Superphosphate and Potash

On November 17th, in simplification of its fertilizer price regulation, the Office of Price Administration set dollars-and-cents maximum prices for every grade of mixed fertilizer, superphosphate and potash whose manufacture and sale is permitted by the War Food Administration.

At the same time, through its action, OPA wiped out inequalities between various grades and between various sellers of fertilizers. These resulted from the previous method of "freezing" the individual prices of each seller according to those he charged during a base period.

No price changes of any real importance have been made in fixing the new price schedules. Ceilings are maintained approximately at the same average level as those which prevailed during the base pricing period in February, 1942. The current OPA action, however, established all prices at the consumer level and substituted them for the former requirement that fertilizer manufacturers calculate prices on their wide variety of grades on their base period prices with percentage mark-ups for some areas.

It will be no longer necessary for manufacturers to apply to OPA for special prices on each new fertilizer mixture they produce in varying grades for widely different areas, as they have in the past.

The eighteen geographical pricing areas set up for domestic sales of mixed fertilizer, superphosphate and potash vary slightly from those designated in the original regulation. They now more closely adhere to selling areas long recognized by the industry.

Each of these areas now is supplied with a single schedule of specific dollars-and-cents prices and delivery requirements. Trade discounts established for these areas coincide with those which the fertilizer industry always has observed.

To accommodate provisions of the current fertilizer regulation to the varying selling seasons, instead of fixing a specific uniform effective date for operation of the regulation, manufacturers are given the option of choosing any date on or after November 23, 1943 (generally accepted to be near the end of the fall season and the month before commencement of the spring selling season), but not later than January 1, 1944.

OPA found the "freeze" type of control, adopted in the former fertilizer regulation,

under which control of maximum prices on sales by manufacturers to dealers was accomplished by dealers' margins on their sales in turn to consumers, to be both inexpedient and unnecessary. Consequently, ceiling prices set under the new regulation all are prices to consumers, whether the fertilizer is sold to them by a manufacturer or dealer. This leaves the manufacturer free to sell to dealers or through his own agents at whatever price below the specified consumer's maximum price the manufacturer and his dealers or agents may agree to.

Previously, manufacturers themselves were allowed to propose to OPA maximum prices for grades which they did not list during the February, 1942, base period. Under that ruling, if the manufacturer received no notice of disapproval from OPA within ten days after submitting his tentative prices, he was permitted to sell at those prices until such time as OPA subsequently might forbid them. This resulted in two serious disadvantages: (1) a wide variety of prices for the same grade of fertilizer sold and delivered in the same area by competitive manufacturers, and (2) physical impossibility for OPA within the ten-day period to pass upon the large number of prices submitted.

In preparing the new regulation, representatives of OPA conducted countrywide consultations with fertilizer manufacturers to make sure that the new ceiling prices would be fair and equitable and would not result in changes in business practices and means of distribution of fertilizer. In addition to conferences with its Fertilizer Industry Advisory Committee, OPA sent representatives to 18 regional and district meetings of the industry in all parts of the country to discuss tentative proposals of the new regulation. Later, a second draft of the proposals was mailed to the industry as a whole.

Canadian Steel Slag as Fertilizer

In keeping with the urgent demand for increased agricultural production, particularly in the Maritime provinces of Canada where a minimum rail haul is required for delivery to Eastern ports, the National Research Council and Department of Agriculture have been conducting extensive investigations on processes to enhance the fertilizing value of phosphatic open hearth slag.

Special attention is being paid to the 150,000 tons of 10 to 12 per cent P_2O_5 slag produced annually by the Dominion Steel and Coal Co., Nova Scotia, for it contains more phosphate than is used annually in all the Maritimes, lime equivalent to two or three times the agricultural consumption of ground limestone in the same area, as well as smaller quantities of manganese, magnesia, sulphur, iron, and minor elements of which deficiencies exist in some soils. Successful utilization of this heretofore waste slag would be of paramount importance to the over-cropped, underfertilized Maritimes.

Manganese Takeup Aided by Fertilizers

Studies of manganese in Illinois soils and crops, as reported by Prof. H. J. Snider of the Illinois Experiment Station, showed that superphosphate increased the manganese uptake by the corn plant to a greater degree than did rock phosphate, and the manganese content of Kentucky bluegrass, timothy, red top, and orchard grass varied with the reaction of the soil and the fertilizer treatment. Most plants require relatively little manganese, but red top and orchard grass apparently require two to three times as much as timothy and bluegrass under the same field conditions. Liming reduces availability of manganese while acid fertilizers increase its availability.

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1252 West Beaver Street
Jacksonville, Fla.

504 Merchants Exchange Bldg., St. Louis, Mo.

FERTILIZER MATERIALS MARKET

NEW YORK

Normal Sulphate of Ammonia Production Resumed After Coal Strike. Excess of Ammonium Nitrate Possible. Lend-Lease Potash Shipments Curtailed. Superphosphate Output Limited by Sulphuric Acid Supply.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, November 16, 1943.

Ammonium Sulphate

Production of this material was curtailed to some extent by the difficulties in the coal regions, but normal production is now again expected with deliveries continuing in good volume.

Ammonium Nitrate

We have been advised by several users of this material that condition of the specially prepared material coming from TVA remains satisfactory while in storage but these same buyers expressed some apprehension regarding deliveries from other sources. With the increased supply of this material now available, there is a question as to whether a ready market will be found for the total quantity.

Nitrate of Soda

It now seems assured that at least half a million tons of nitrate of soda will be imported into this country for the fertilizer season, any increase depending on shipping conditions.

Potash

It now appears that instead of 60,000 tons of this material being shipped against Lend-Lease, the quantity may be reduced to 30,000 tons. If there is no change and if suppliers can furnish the domestic buyers with this additional 30,000 tons, naturally the lack of potash will be alleviated to some extent.

Superphosphate

Production is continuing with possibility of some new plants going into operation but new production would not be available for the present fertilizer season. All manufacturers are producing at capacity, subject to supplies of sulphuric acid being available.

BALTIMORE

Poor Mechanical Condition of Some Ammonium Nitrate Shipments Causes Criticism. Some Cottonseed Meal Released for Fertilizers.

Exclusive Correspondence to "The American Fertilizer"

BALTIMORE, November 16, 1943.

Of most interest during the past two weeks has been the question of mechanical condition of ammonium nitrate, and until manufacturing control insures stabilized mechanical condition, quite a number of the fertilizer manufacturers prefer not to handle it.

Ammoniates.—There is nothing new in the situation and feeders are taking deliveries of organic ammoniates as fast as produced at ceiling prices. Food production order No. 12 provides for limited tonnage of edible cottonseed meal for use in fertilizer, realizing situation on ammoniates is critical. Fertilizer manufacturers are permitted to purchase 70 per cent of tonnage used in mixed fertilizer during season 1941–42.

Castor Pomace.—The situation remains firm with important producers sold up, not taking on any further business. The ceiling price of $2.90 per unit of ammonia ($3.52½ per unit N), f. o. b. producers' works is, therefore, strictly nominal.

Sulphate of Ammonia.—Most of the manufacturers are anxious to secure increased allocations of this material in preference to taking ammonium nitrate which latter product still has a tendency to cake after mixing.

Nitrate of Soda.—There is considerable agitation regarding reports of almost 50 per cent curtailment of the imported product. Manufacturers as well as farming consumers were hoping for an increased tonnage rather than curtailed delivery. The market remains unchanged at previously reported levels.

Superphosphate.—There is nothing new in the situation and as far as can be learned the

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✣

PHOSPHATE ROCK

✣

SUPERPHOSPHATE

✣

DOUBLE SUPERPHOSPHATE

✣

SULPHURIC ACID

✣

BONE MEALS

✣

DRIED BLOOD

✣

TANKAGES

✣

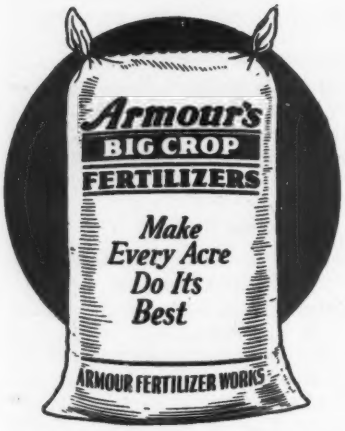
BONE BLACK

✣

PIGMENT BLACK

✣

SODIUM FLUOSILICATE



ARMOUR FERTILIZER WORKS

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Baltimore, Md.
Birmingham, Ala.
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Cincinnati, Ohio
Columbia, S. C.
Columbus, Ga.
East St. Louis, Ill.
Greensboro, N. C.
Havana, Cuba
Houston, Texas
Jacksonville, Fla.
Montgomery, Ala.
Nashville, Tenn.
New Orleans, La.
New York, N. Y.
Norfolk, Va.
Presque Isle, Me.
San Juan, P. R.
Sandusky, Ohio
Wilmington, N. C.

Government has not released any important quantity of sulphuric acid to permit increased production of superphosphate. The market is, therefore, firm at ceiling price of 64 cents per unit.

Fish Meal.—Stocks in the hands of dealers are being conserved, and it is almost next to impossible to secure any appreciable quantities even at ceiling price.

Potash.—Protest has been registered in several quarters against further exportations until after American agricultural demand has been met.

Bone Meal.—The market is still strong with offerings few and far between.

Bags.—There is no change in the situation and as practically all manufacturers have now made arrangements for their requirements for the coming season, the authorization to use new burlap bags for fertilizer would come so late that no material benefit would be derived for the coming spring season's use.

CHARLESTON

Improvements Being Made in Ammonium Nitrate Manufacture. Limited Amount of Cottonseed Meal to be Distributed for Fertilizer.

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, November 15, 1943.

Nitrogenous.—There are still no additional offerings of processed tankage.

Castor Pomace.—It is hoped now that the quantity available later will be increased, but so far the market continues restricted.

Ammonium Nitrate.—This material has been further improved and satisfactory tests have been made on material stored for at least six weeks under atmospheric conditions similar to those in the South. The entire amount so far produced has been taken up by buyers.

Superphosphate.—Sulphuric acid continues to be the block preventing, so far, the production of superphosphate desired by the War Production Board.

Cottonseed Meal.—It has just been announced by Food Production Order No. 12, Revision 2, that there is a provision for the distribution of a limited amount of cottonseed meal for use in fertilizer. The restriction by which manufacturers are limited to 70 per cent of organic materials that they used in the fiscal year 1941–42 also applies to seed meals. The buyer, to become eligible, must file an application with the Director of the Office of Materials and Facilities, War Food Administration. Applications are not required for other types of organic materials. As, however, the amount of seed meals is limited, an approved purchaser will only be able to buy a smaller amount than 70 per cent of the seed meals that he used in 1941–42.

PHILADELPHIA

Washington Reports Several New Fertilizer Developments. Nitrogen Problems Getting Serious Attention. Potash Demand Good.

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, November 15, 1943.

The market remains about the same as previously reported. During the past two weeks, much attention was centered upon Washington as news of interest to the fertilizer industry kept popping up. Most of this news has already been reported, but it involved the permission to use cottonseed meal in mixed fertilizers, the effort of the WFA to allocate organic nitrogen, and the shipments of potash to the United Kingdom being curtailed. Shipments of mixed fertilizer in October were reported quite heavy, and it is thought that much of this will be used for spring, and thus relieve some of the pressure when that busy season is reached.

Manufacturers' Sales Agents for **DOMESTIC**

Sulphate of Ammonia

Ammonia Liquor :: Anhydrous Ammonia

HYDROCARBON PRODUCTS CO., INC.

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Ammoniates.—The situation on the inorganic materials is apparently coming in for serious attention, in an effort to assure sufficient nitrogen for the farms. As for the organic materials, they are still scarce, and mixers, we are told, will be permitted to use up to 70 per cent of the organic nitrogen used in previous years.

Sulphate of Ammonia.—Production apparently maintained a fair rate despite the coal strike, which might have had a retarding effect in some places.

Nitrate of Soda.—Effort is apparently being made in Washington to bring in some of the Chilean material.

Superphosphate.—Production seems to stay at good level, although sulphuric acid supplies will have to be augmented to maintain the rate.

Bone Meal.—Still among the scarce items.

Potash.—Shipments to United Kingdom will be curtailed by the Chemicals and Fertilizer Branch of the WFA, unless they are told otherwise. The demand by the fertilizer industry continues good.

CHICAGO

Fertilizer Organics Supply Being Allotted with Caution. Heavy Hog Receipts Should Relieve Feed Shortage.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, November 15, 1943.

Demand consistently exceeded supply in the organic market. Caution in making commitments still prevails with producers, and new releases have as yet not come forth. Probably some allotments will be made before the end of this month. Ceilings are well maintained.

Recent receipts of unusually large numbers of hogs in packing centers should ultimately influence the present tight feed situation. These heavy receipts should result in a lessened demand for feed, and an increased production of feed material.

PLOWING UNDER FERTILIZER GETS RESULTS

(Continued from page 8)

plowing under fertilizer proves conclusively that Dr. G. D. Scarseth, Purdue agronomist, is right when he says, "No land is poor if the right amount of the right kind of fertilizer put in the right place can make that land produce profitable yields."

Proving that crops burn up due to lack of plant food and not because of dry weather, Roscoe points to acres of lespedeza where the plants are almost knee high and still green and vigorous in spite of heavy grazing and 45 hot, rainless summer days. He is thoroughly sold on the argument that fertilizer placed deep on the plow sole is available to the plant during moderately dry weather, while that placed closer to the surface is not. He believes, however, that small amounts of fertilizer (100–200 pounds) should be drilled in at the time of seeding to act as a starter.

This fall he is using his breaking plow fertilizer attachment to apply 500 pounds of 3–12–12 at the plow sole, preparatory to building a pasture of orchard grass and lespedeza. Using one bushel of rye an acre as a cover crop, he will apply 100 pounds of additional fertilizer when he sows one bushel of orchard grass in late August, with lespedeza being seeded next spring. Roscoe says that his past experience shows that orchard grass provides the early pasture, with lespedeza coming on in late May or about the time orchard grass starts to fade.

Proving that the right amount of the right kind of fertilizer placed at the right depth will build a pasture that will stand even the longest drouth, Roscoe proudly exhibits a field of lespedeza pasture so tall that a good-sized lamb can hide in it.

Pastures inspected in late August and found to be in fine condition—in spite of more than

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Victory strategist maps out spring campaign

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Essential in achieving rich, abundant growth and warding off plant disease are fertilizers, many of them compounded with potash. Your products will enable the farmers to obtain better crops and larger yields.

Thus Sunshine State Higrade Muriate of Potash and other grades you know serve on the nation's Food Front to hasten Victory.

ARMY E NAVY

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UNITED STATES POTASH COMPANY

TRADE-MARK REG. U. S. PAT. OFF.

six weeks of hot, dry weather—were old lespedeza pastures that had been improved by applying 400 pounds of 0–21–9 an acre. When this fertilizer was applied a year ago, lespedeza was reseeded by mixing seed in with the fertilizer at the rate of 14 pounds per acre. While heavy grazing and lack of rain had apparently had little effect on these pastures, others in the same section and on the same type of soil that had received little or no fertilizer were badly burned up.

Speaking from practical tests made on his own farm, Roscoe predicts even better pastures in the future. He is so thoroughly convinced that what has often been called thin land will produce good pastures that he is plowing up 100 acres of old pastures this fall in order to get "the proper amount of the right kind of fertilizer at exactly the right depth." Roscoe concludes: "Give lespedeza that and it can be counted on to carry through until frost."

PHOSPHATE FIXATION IN SOILS

(Continued from page 7)

more rapidly than plants can take them up, the unused portion being fixed by the soil. For this reason much attention has been paid to the use of less soluble forms.

Insoluble phosphates. Water-insoluble forms of phosphate, such as ground mineral phosphate, bone manures, basic slag and reverted phosphates, are far less rapidly dissolved in the soil and, as a result, are less rapidly fixed. Where fixation in unavailable forms is serious, e.g., in acid soils, some of these materials may be used with advantage. In general, however, superphosphate is not easily surpassed.

(a) *Mineral phosphate and bone manures.* Because of their very low solubility these materials are best suited for use in acid soils where they are more soluble and available. In certain types of acid soils very deficient in phosphate, they might well be better than superphosphate, and this possibly accounts to some extent for the preference which is sometimes expressed for bone manures. There is, however, no direct experimental evidence to show that bones and ground mineral phosphate are superior to superphosphate, even in relatively acid soils, and it is impossible to generalize in this connection.

(b) *Basic slag.* As a rule there is very little to choose between superphosphate and high-soluble basic slag as sources of phosphate. Basic slag has, however, an advantage in acid soils in that it supplies a small amount of lime.

(c) *Reverted phosphates.* These are obtained by adding certain materials to superphosphate to make the phosphate insoluble in water. The soluble phosphate present in superphosphate is called mono-calcium phosphate. There are two other forms of calcium phosphate which are called di-calcium phosphate and tri-calcium phosphate. Both these are insoluble in water, but the di-calcium phosphate is very available to plants, and the tri-calcium phosphate considerably so. The available calcium phosphates precipitated in slightly acid to neutral soils are probably very similar to these two phosphates, if not the same. Being less soluble, the di- and tri-calcium phosphates are less rapidly fixed than the mono-calcium phosphate, i.e., superphosphate, and the main object of reverting superphosphate is to convert it into these less rapidly fixed forms. The di-calcium phosphate, with its high availability and low rate of fixation, is especially desirable. There are two kinds of reverted phosphate which have received considerable attention recently. One of these is prepared using dolomite, a magnesium limestone, and the other using serpentine, a silicate of magnesium. The dolomite form was developed in America, and it is claimed that practically all the phosphate in it exists as di-calcium phosphate, and the even more desirable di-magnesium phosphate. The serpentine form is largely a New Zealand development, and is claimed to be superior to superphosphate as a fertilizer. Both products are said to have superior physical properties, and to be very suitable for drilling. Their value as fertilizers under British conditions is being tested, and it remains to be seen whether they can be used with advantage in this country.

The fact that crops vary both in their response to phosphate and in the extent to which they are able to feed on the less available forms of phosphate must also be taken into consideration in order to make the best use of phosphate fertilizers. The other point of general importance is that fixation in unavailable forms takes place to a smaller extent the higher the reserve of phosphate in the soil.

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ADD SALES APPEAL to your product through better packaging.

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You can benefit from the counsel of a Bemis Multiwall Paper Bag Expert whether you are a Bemis customer or not. So please feel free to call upon us any time you have a troublesome bagging problem. You'll find the Bemis Man an expert on all phases of such problems, from bag design to closing machinery, shipping and storing. Let him study your bagging operations to see if he can increase output, lower man power, cut costs or reduce waste for you. His call will cost you nothing and place you under no obligation.

SAVE 8 MEN IN PACKING AND LOADING OPERATION

A plant shipping products in multiwall bags required 16 men to pack and load their output. A Bemis Multiwall expert recommended rearrangement of packing equipment and slight mechanical changes. Results: 8 men doing the work previously requiring 16!

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MENTION "THE AMERICAN FERTILIZER" WHEN WRITING TO ADVERTISERS.

In very deficient soils it is often the case that very little return is obtained until the necessary reserve has been built up. It is generally more economic to do this by adding heavy dressings to begin with than to do it gradually by adding light dressings.

(3) *Using efficient methods of applying phosphate.* Fixation occurs most readily when phosphates are broadcast in powdered form and mixed up with the whole mass of cultivated soil. The efficiency of phosphate fertilizers can be increased by the following methods:

(a) *Applying them in granular form.* Phosphates in the form of granules are less readily fixed because there is less surface exposed to the soil. In addition, the soil in the immediate vicinity of the granules eventually becomes well saturated with phosphate, much of which is therefore held in readily available form. The use of granules also decreases the rate at which the phosphate dissolves, because large particles dissolve more slowly than small ones. The cores of the granules probably remain largely unaltered for a considerable time. Incorporation of phosphates, especially water-soluble forms, as granules in the cultivated layer of soil has the great advantage of providing a large number of pockets of readily available phosphate into which the plant roots penetrate. Granular fertilizers have the further advantage of being very suitable for drilling. The use of larger particles or pellets has also been suggested. The use of granules applies only to the more soluble phosphates. With very insoluble forms, such as bones and mineral phosphates, fineness of grinding is, of course, very important.

(b) *Placing them in concentrated layers in the soil.* This method is generally known as fertilizer placement. Suitable placement of phosphates close to the seed or to the plant roots generally increases their efficiency to such an extent compared with broadcast application that the amounts necessary can be considerably reduced. Placement of phosphate in this manner provides the plants with high concentrations of available phosphate in the immediate zone of action of the roots, and is a most effective way of combating fixation. Ploughing down phosphate after broadcasting also serves to transfer it down to the root zone and has been found advantageous. In Sweden, for example, much higher yields of cereals were obtained when the phosphate was ploughed down to a depth of four inches. The most suitable placement varies, of course, for different crops, and much remains to be learned about this question. In American experiments with potatoes good results have been obtained by applying the fertilizer in two bands, placed, one on each side, two inches away from and at about the same level as the undersides of the potatoes. With oats, the grain and fertilizer are usually drilled in together. So far, this subject has been comparatively little studied in this country, but experiments now in hand should provide much useful information.

Conclusions

The object of this account of phosphate fixation in soils is to indicate and illustrate the main aspects of the problem and the ways in which it is being tackled, and it is of necessity considerably over-simplified in many respects. There is still a great deal to be learned about the exact nature of fixation in different types of soils, its significance in relation to phosphate availability, and its bearing on the types of phosphate fertilizers to be used, together with the best ways of applying them. It is important to appreciate that information obtained from experiments on one type of soil does not of necessity hold for other types, nor does the information obtained in one country necessarily apply in another where climatic and other conditions are different. Thus, the reverted phosphates which have proved so valuable in other countries may well prove to be of equal value on certain soils in this country, but until direct experimental evidence is available this cannot be assumed. This question and others like it, together with other aspects of the problem, are being investigated. In Scotland, however, the great majority of the soils are acid, and in these there is no doubt that fixation in unavailable forms is unnecessarily high, and can be reduced by adequate applications of lime with consequent increases in the efficiency of the phosphate fertilizers that are so widely used.

Fertilizer Machinery *AND* Acidulating Equipment

BATCH MIXERS — PULVERIZERS — CAGE MILLS — SCREENS — SCALES
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Pioneer Producers of Muriate of Potash in America

See Page 4

REVISION OF FERTILIZER ORDER

(Continued from page 11)

New England Area

Maine: 0–14–14; 3–12–6; 5–7–10; 5–8–7[1]; 5–10–5[2]; 5–10–10; 6–9–15; 7–7–7.

New Hampshire: 0–14–14; 3–12–6; 5–8–7[1]; 5–10–5[2]; 5–10–10; 6–3–6[3]; 7–7–7.

Vermont: 0–14–14; 3–12–6; 5–8–7[1]; 5–10–5[2]; 5–10–10; 6–3–6[3]; 7–7–7.

Massachusetts: 0–14–14; 3–12–6; 4–10–0[3]; 5–3–5[1 3]; 5–8–7[1]; 5–10–5[2]; 5–10–10; 6–3–6[3]; 7–7–7.

Rhode Island: 0–14–14; 3–12–6; 5–8–7[1]; 5–10–5[2]; 5–10–10; 7–7–7.

Connecticut: 0–14–14; 3–12–6; 4–10–0[3]; 5–3–5[1 3]; 5–8–7[1]; 5–10–5[2]; 5–10–10; 6–3–6[3]; 7–7–7.

[1]No multiples permitted.

[2]This grade is designated for use on victory gardens in conformity with the provisions of paragraphs (b) (2) and (b) (4), but is not limited to such use.

[3]Tobacco only.

Unless prohibited hereinabove, multiples of the foregoing approved grades may be manufactured and delivered for use.

Middle Atlantic Area

New York: 0–10–20; 0–12–12; 0–14–7; 2–12–6; 3–9–12; 3–9–15[1]; 3–12–6; 4–8–12; 4–12–4; 4–12–8; 5–10–5[2]; 5–10–10; 7–7–7.

Pennsylvania: 0–12–12; 0–14–7; 2–12–6; 3–9–12; 3–12–6; 4–8–12; 4–12–4; 4–12–8; 5–10–5[2]; 5–10–10; 7–7–7; 10–6–4.

New Jersey: 0–12–12; 0–14–7; 2–12–6; 3–9–12; 3–9–15[1]; 3–12–6; 4–8–12; 4–12–4; 4–12–8; 5–8–7; 5–10–5[2]; 5–10–10; 7–7–7; 10–6–4.

Delaware: 0–12–12; 0–14–7; 2–12–6; 3–9–12; 3–12–6; 4–8–12; 4–12–4; 4–12–8; 5–10–5[2]; 5–10–10; 6–8–6; 7–7–7[3]; 10–6–4.

Maryland: 0–12–12; 0–14–7; 2–12–6; 2–12–12[4]; 3–9–12[4]; 3–12–6; 4–8–12[4]; 4–12–4; 4–12–8; 5–10–5[2]; 5–10–10; 6–8–6; 7–7–7[3]; 10–6–4.

Virginia: 0–12–12; 0–14–7; 2–12–6; 3–8–5[5]; 3–9–6[5]; 3–9–12; 3–12–6; 4–9–3[5]; 4–10–4; 4–12–4; 4–12–8; 5–10–5[2]; 6–8–4; 6–8–6; 7–7–7[3]; 10–6–4[6].

West Virginia: 0–12–12; 0–14–7; 2–12–6; 3–12–6; 4–12–4; 4–12–8; 5–10–5[2]; 5–10–10; 10–6–4.

[1]Muck only.

[2]This grade is designated for use on victory gardens in conformity with the provisions of paragraphs (b) (2) and (b) (4), but is not limited to such use.

[3]Top dressing only.

[4]This grade may be used on tobacco, but is not limited to such use.

[5]Tobacco only.

[6]Not for use on vegetable crops.

Multiples of the foregoing approved grades may be manufactured and delivered for use.

Southeastern Area

North Carolina: 0–10–10 (basic); 0–12–12; 0–14–7; 2–10–6; 2–12–6; 3–8–5[1]; 3–9–6[1]; 3–9–9; 3–12–6; 4–8–8; 4–9–3[1]; 4–10–4; 4–10–6; 4–12–4; 5–5–20[1]; 5–7–5; 5–10–5[2]; 6–8–4; 6–8–6; 10–0–10.

South Carolina: 0–12–12; 0–14–7; 2–12–6; 3–9–6; 3–9–9; 3–12–6; 4–8–8; 4–9–3[1]; 4–10–4; 4–10–6; 4–12–4; 5–10–5[2]; 6–8–6; 10–0–10.

Georgia: 0–14–7; 0–14–10; 2–12–6; 3–9–6; 3–9–9[1]; 4–8–6; 4–8–8[5]; 4–9–3[1]; 4–10–4; 4–10–8[1]; 4–12–4; 5–10–5[2]; 6–8–4; 6–8–6; 10–0–10.

Alabama: 0–14–10; 3–9–9[1]; 4–10–4; 4–10–6; 5–10–5[3]; 6–8–4.

Mississippi: 0–14–7; 4–8–8; 5–10–5[2]; 6–8–4.

Tennessee: 0–12–12; 0–14–4; 0–14–7; 2–12–6; 2–14–4[4]; 3–9–6; 3–9–9; 4–8–8; 4–9–3[1]; 4–12–4[2]; 5–10–5; 6–8–4; 8–5–5.

[1]Tobacco only.

[2]This grade is designated for use on victory gardens in conformity with the provisions of paragraphs (b) (2) and (b) (4), but is not limited to such use.

[3]This grade is designated for use on victory gardens only in conformity with the provisions of paragraphs (b) (2) and (b) (4).

[4]Fall seeded small grains only.

[5]For use on Group A crops only.

Florida Area

Florida: 0–8–12; 0–8–24; 0–10–10; 0–12–16; 0–14–5; 0–14–10; 0–16–0 plus Mn; 2–8–6; 2–8–10; 2–10–4; 3–6–8; 3–6–10; 3–8–5; 3–8–8; 4–4–8; 4–5–7; 4–6–8; 4–7–5; 4–8–4; 4–8–6; 4–8–8; 4–9–3; 4–10–7; 4–12–4; 4–12–6; 5–5–8; 5–6–10; 5–7–5; 5–8–8; 5–10–5[1]; 6–4–8; 6–6–6; 8–0–8; 8–0–12; 12–0–10.

[1]This grade is designated for use on victory gardens only in conformity with the provisions of paragraphs (b) (2) and (b) (4).

"Why shouldn't I buy it? I've got the money!"

Sure you've got the money. So have lots of us. And yesterday it was all ours, to spend as we darn well pleased. But not today. Today it isn't ours alone.

"What do you mean, it isn't mine?"

It isn't yours to spend as you like. None of us can spend as we like today. Not if we want prices to stay down. There's more money today—less to buy. If we all start scrambling to buy everything in sight, prices can kite to hell-'n'-gone.

"You think I *can really keep prices down?"*

If you don't, who will? Uncle Sam can't do it alone. Every time you refuse to buy something you don't need, you're helping to keep prices down.

"But I thought the government put a ceiling on prices."

You're right, a price ceiling for your protection. And it's up to you to pay no more than the ceiling price. If you do, you're party to a black market deal. And that boosts prices—causes shortages.

"Doesn't rationing take care of shortages?"

Your ration coupons will—if you use them wisely. Don't spend them unless you have to. Your ration book merely sets a limit on your purchases. Every coupon you don't use today means that much more for you—and everybody else—to share tomorrow.

"Then what do you want me to do with my money?"

Save it! Put it in the bank! Put it in life insurance! Pay off old debts and don't make new ones. Buy and hold War Bonds. Keep your dollars out of circulation and they'll keep prices down. The government is helping—with taxes.

"Now wait! How do taxes help keep prices down?"

We've got to pay for this war sooner or later. It's easier and cheaper to pay as we go—while we've got the extra money to do it. Every dollar put into taxes means a dollar less to boost prices. So...

Use it up...Wear it out...
Make it do...Or do without

A UNITED STATES WAR MESSAGE PREPARED BY THE WAR ADVERTISING COUNCIL; APPROVED BY THE OFFICE OF WAR INFORMATION; AND CONTRIBUTED BY THE MAGAZINE PUBLISHERS OF AMERICA

West South Central Area

Arkansas: 0–10–20; 0–12–12; 0–14–7; 3–9–18; 4–8–12; 4–12–4; 4–12–6; 5–10–5[1]; 6–8–4; 10–0–10; 12–8–0[2].

Louisiana: 0–12–12; 0–14–7; 3–12–12; 4–8–8; 4–12–4; 4–12–6; 5–10–5[1]; 6–8–4; 10–0–10; 12–8–0[2].

Texas: 0–14–7; 4–10–0; 4–8–8; 4–12–4; 4–12–6; 5–10–5[1]; 6–8–4; 6–12–0[3]; 6–30–0[4]; 10–10–0[3]; 10–20–0[4]; 12–15–0[4].

Oklahoma: 0–14–7; 2–12–6; 4–12–0; 4–12–4; 4–12–6; 5–10–5[1].

[1]This grade is designated for use on victory gardens in conformity with the provisions of paragraphs (b) (2) and (b) (4), but is not limited to such use.

[2]Sugarcane only.

[3]Rio Grande Valley only.

[4]Panhandle and West Texas only.

Middle West Area

Illinois: 0–9–27; 0–10–20; 0–12–12; 0–14–7; 0–14–14; 0–20–10; 0–20–20; 2–12–6; 2–16–8; 3–9–18; 3–12–12; 3–18–9; 4–10–6; 4–12–4[1]; 8–8–8; 10–6–4.

Indiana: 0–9–27; 0–10–20; 0–12–12; 0–14–7; 0–14–14; 0–20–10; 0–20–20; 2–12–6; 2–16–8; 3–9–18; 3–12–12; 3–18–9; 4–10–6; 4–12–4[1]; 8–8–8; 10–6–4.

Iowa: 0–9–27; 0–10–20; 0–12–12; 0–14–7; 0–14–14; 0–20–10; 0–20–20; 2–12–6; 3–9–18; 3–12–12; 3–18–9; 4–10–6; 4–12–4[1]; 4–16–4; 10–6–4.

Minnesota: 0–9–27; 0–10–20; 0–12–12; 0–12–24; 0–12–36; 0–14–7; 0–14–14; 0–20–10; 0–20–20; 0–30–15; 2–12–6; 2–16–8; 3–9–18; 3–12–12; 3–18–9; 4–10–6; 4–12–4[1]; 4–16–16; 4–24–12; 6–12–18; 8–8–8; 8–16–12; 10–6–4.

Ohio: 0–9–27; 0–10–20; 0–12–12; 0–14–7; 0–14–14; 0–20–10; 0–20–20; 2–12–6; 3–9–18; 3–12–12; 3–18–9; 4–10–6; 4–12–4[1]; 5–10–10; 8–8–8; 10–6–4.

Wisconsin: 0–9–27; 0–10–20; 0–12–12; 0–14–7; 0–14–14; 0–20–10; 0–20–20; 2–12–6; 3–9–18; 3–12–12; 3–18–9; 4–10–6; 4–12–4[1]; 8–8–8; 10–6–4.

Michigan: 0–9–27; 0–10–20; 0–12–12; 0–14–7; 0–14–14; 0–20–10; 0–20–20; 2–12–6; 2–16–8; 3–9–18; 3–12–12; 3–18–9; 4–10–6; 4–12–4[1]; 4–16–4; 8–8–8; 10–6–4.

Missouri: 0–10–20; 0–12–12; 0–14–7; 0–14–14; 0–20–10; 0–20–20; 2–12–6; 3–9–18; 3–12–12; 3–18–9; 4–10–6; 4–12–4[2]; 5–10–10; 10–6–4.

Kentucky: 0–12–12; 0–14–4; 0–14–7; 0–14–14; 0–20–10; 0–20–20; 2–12–6; 2–14–4[3]; 3–9–6; 3–12–12; 4–10–6; 4–12–14[2]; 4–12–8; 5–10–10; 6–8–6; 10–6–4.

[1]This grade is designated for use on victory gardens only in conformity with the provisions of paragraphs (b) (2) and (b) (4).

[2]This grade is designated for use on victory gardens in conformity with the provisions of paragraphs (b) (2) and (b) (4), but is not limited to such use.

[3]Fall seeded small grains only.

Pacific Coast Area

Arizona: 4–8–10 (manure base only); 4–12–4; 4–19–5; 6–10–4[1]; 6–12–0; 6–18–0; 8–8–0; 8–12–0; 8–16–0; 10–10–0; 10–20–0; 10–38–0; 14–6–0.

California: 0–10–12; 2–10–8; 4–6–8; 4–10–10; 4–12–4; 4–18–18; 5–12–5; 5–14–9; 6–9–6; 6–10–4[1]; 6–12–8; 8–0–12; 8–6–8; 8–8–4; 8–10–12; 10–5–5; 10–5–10; 10–10–0; 10–10–5; 10–12–10; 10–16–8; 10–20–0; 12–0–14; 12–6–0; 14–0–8; 17–7–0.

Oregon: 0–12–20; 3–10–10; 3–10–20; 4–12–4; 4–24–0; 4–24–4; 5–6–8; 5–10–5; 5–10–10; 6–10–4[1]; 6–30–0; 9–4–6; 10–12–14; 10–16–8; 10–20–0; 12–12–0.

Washington: 0–12–20; 3–10–10; 3–10–20; 4–12–4; 4–24–0; 5–6–8; 5–10–5; 5–10–10; 6–10–4[1]; 6–30–0; 9–4–6; 10–12–14; 10–20–0; 12–12–0; 17–4–4; 17–12–0.

Idaho: 0–12–20; 3–10–10; 3–10–20; 4–12–4; 4–24–0; 5–10–5; 5–10–10; 6–10–4[1]; 6–30–0; 10–20–0.

[1]This grade is designated for use on victory gardens in conformity with the provisions of paragraphs (b) (2) and (b) (4), but is not limited to such use.

Schedule II—Group A Crops

I. Field crops.
   - (a) Peanuts.
   - (b) Sugar beets for production of seed.
   - (c) Hemp.
   - (d) Hybrid corn for production of seed only.

II. Vegetable crops.
   - (a) Beans, dried.
   - (b) Beans, snap.
   - (c) Beans, lima.
   - (d) Cabbage.
   - (e) Carrots.
   - (f) Onions.
   - (g) Peas, dried edible.
   - (h) Peas.
   - (i) Potatoes, Irish.
   - (j) Potatoes, sweet.
   - (k) Sweet corn for processing only.
   - (l) Tomatoes.
   - (m) Vegetable seeds.

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the number of pounds of raw material for a desired per cent. of plant food in a ton of mixed goods—or find what per cent. of a certain plant food in a ton of fertilizer produced by a specific quantity of raw materials.

No mathematical calculations are necessary. You can find the figures in a few seconds with the aid of

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To make clearer its use, answers to such problems as the following can be quickly obtained:

How much sulphate of ammonia, containing 20 per cent. of nitrogen, would be needed to give 4½ per cent. nitrogen in the finished product?

Seven hundred and fifty pounds of tankage, containing 8 per cent. phosphoric acid are being used in a mixture. What per cent. of phosphoric acid will this supply in the finished goods?

Should the Adams' Formula Rule become soiled from handling, it may be readily cleaned with a damp cloth.

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MENTION "THE AMERICAN FERTILIZER" WHEN WRITING TO ADVERTISERS

BUYERS' GUIDE • A CLASSIFIED INDEX TO ALL THE ADVERTISERS IN "THE AMERICAN FERTILIZER"

This list contains representative concerns in the Commercial Fertilizer Industry, Including fertilizer manufacturers, machinery and equipment manufacturers, dealers in and manufacturers of commercial fertilizer materials and supplies, brokers, chemists, etc.
For Alphabetical List of Advertisers, see page 33.

ACID BRICK
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

ACID EGGS
Chemical Construction Corp., New York City.

ACIDULATING UNITS
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMO-PHOS
American Cyanamid Co., New York City.

AMMONIA—Anhydrous
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA LIQUOR
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA OXIDATION UNITS
Chemical Construction Corp., New York City.

AMMONIATING EQUIPMENT
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMONIUM NITRATE SOLUTIONS
Barrett Division, The, Allied Chemical & Dye Corp., New York City.

AUTOMATIC ELEVATOR TAKEUPS
Sackett & Sons Co., The A. J., Baltimore, Md.

BABBITT
Sackett & Sons Co., The A. J., Baltimore, Md.

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Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.
St. Regis Paper Co., New York City.
Textile Bag Mfrs. Association, Chicago, Ill.
Union Bag & Paper Corporation, New York City.

BAGS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.
Textile Bag Mfrs. Association, Chicago, Ill.

BAGS—Paper
Bagpak, Inc., New York City
Bemis Bro. Bag Co., St. Louis, Mo.
St. Regis Paper Co., New York City.
Union Bag & Paper Corporation, New York City.

BAGS (Waterproof)—Manufacturers
Bemis Bro. Bag Co., St. Louis, Mo.
St. Regis Paper Co., New York City.
Textile Bag Mfrs. Association, Chicago, Ill,
Union Bag & Paper Corporation, New York City.

BAGS—Dealers and Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

BAG CLOSING MACHINES
Bagpak Inc., New York City.
St. Regis Paper Co., New York City.

BAGGING MACHINES—For Filling Sacks
Atlanta Utility Works, East Point, Ga.
Bagpak, Inc., New York City.
St. Regis Paper Co., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

BAG PILERS
Link-Belt Company, Philadelphia, Chicago.

BEARINGS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BELT LACING
Sackett & Sons Co., The A. J., Baltimore, Md.

BELTING—Chain
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

BELTING—Leather, Rubber, Canvas
Sackett & Sons Co., The A. J., Baltimore, Md.

BOILERS—Steam
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Armour Fertilizer Works, Atlanta, Ga.
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Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

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Pacific Coast Borax Co., New York City.

BROKERS
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Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Dickerson Co., The, Philadelphia, Pa.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Keim, Samuel L., Philadelphia, Pa.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BUCKETS—Elevator
Link-Belt Company, Philadelphia, Chicago
Sackett & Sons Co., The A. J., Baltimore, Md
Stedman's Foundry and Mach. Works, Aurora, Ind

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BURNERS—Oil
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CABLEWAYS
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CARS—For Moving Materials
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CARTS—Fertilizer, Standard and Roller Bearing
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Sackett & Sons Co., The A. J., Baltimore, Md.

CASTINGS—Acid Resisting
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Duriron Co., Inc., The, Dayton, Ohio.

CASTINGS—Iron and Steel
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Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CEMENT—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

CHAIN DRIVES—Silent
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Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAINS AND SPROCKETS
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Sackett & Sons Co., The A. J., Baltimore, Md.
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Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

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American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
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Phosphate Mining Co., The, New York City.
Wellmann, William E., Baltimore, Md.

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Chemical Construction Corp., New York City.
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Stillwell & Gladding, New York City.
Wiley & Company, Baltimore, Md.

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Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CONDITIONERS AND FILLERS
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Dickerson Co., The, Philadelphia, Pa.
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CONTACT ACID PLANTS
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COPPER SULPHATE
Tennessee Corporation, Atlanta, Ga.

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Schmaltz, Jos. H., Chicago, Ill.
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CRANES AND DERRICKS
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American Agricultural Chemical Co., New York City
American Cyanamid Co., New York City.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Jett, Joseph C., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

DENS—Superphosphate
Chemical Construction Corp., New York City.
Stedman's Foundry and Mach. Works, Aurora, Ind.

Andrew M. Fairlie
CHEMICAL ENGINEER
22 Marietta Street Building ATLANTA, GA.
CABLE ADDRESS: "SULFACID ATLANTA"

SULPHURIC Acid Plants . . . Design, Construction, Equipment . . . Operation . . . Mills-Packard Water-Cooled Acid Chambers, Gaillard Acid-Cooled Chambers, Gaillard Acid Dispersers, Contact Process Sulphuric Acid Plants.

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American Cyanamid Company, New York City.
Armour Fertilizer Works, Atlanta, Ga.
Farmers Fertilizer Company, Columbus, Ohio.
International Minerals and Chemical Corporation, Chicago, Ill.
Phosphate Mining Co., The, New York City.
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GARBAGE TANKAGE
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GEARS—Machine Moulded and Cut
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GELATINE AND GLUE
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Hayward Company, The, New York City.

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Ashcraft-Wilkinson Co., Atlanta, Ga.
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Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

IRON SULPHATE
Tennessee Corporation, Atlanta, Ga.

INSECTICIDES
American Agricultural Chemical Co., New York City.

LACING—Belt
Sackett & Sons Co., The A. J., Baltimore, Md.

LIMESTONE
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American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
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LOADERS—Car and Wagon, for Fertilizers
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making
Atlanta Utility Works, East Point, Ga.
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Chemical Construction Corp., New York City.
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Fairlie, Andrew M., Atlanta, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Coal and Ash Handling
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, East Point, Ga.
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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Baker & Bro., H. J., New York City.
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Schmaltz, Jos. H., Chicago, Ill.
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NITRATE OVENS AND APPARATUS
Chemical Construction Corp., New York City.

NITROGEN SOLUTIONS
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NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
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Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
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NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PACKING—For Acid Towers
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Wellmann, William E., Baltimore, Md.

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PIPES—Chemical Stoneware
Chemical Construction Corp., New York City.

PIPES—Wooden
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Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
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POTASH SALTS—Manufacturers
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Potash Co. of America, New York City.
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Atlanta Utility Works, East Point, Ga.
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Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., New York City.
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Inquiries Invited

SAMUEL D. KEIM
(SINCE 1898)
1612 MARKET STREET
PHILADELPHIA 3, PA.

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This is our Fig. 645 Nozzle. Used for Scrubbing Acid Phosphate Gases. Made for "full" or "hollow" cone in Brass and "Everdur." We also make "Non-Clog" Nozzles in Brass and Steel, and

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now used by nearly all chamber spray sulphuric acid plants.

CATALOG 6-C

MONARCH MFG. WORKS, INC.
Westmoreland and Emery Sts., Philadelphia, Pa.

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27 South Gay Street - BALTIMORE, MD.

Stillwell & Gladding

Established 1868

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Manufacturers

COMPLETE FERTILIZERS
BULK SUPERPHOSPHATE
SULPHURIC ACID

Acid plant capacity, 45,000 tons. Fertilizer plant capacity, 50,000 ton

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Specialty: Analysis of Fertilizer Materials and Phosphate Rock. Official Chemists for both Florida Hard Rock Phosphate and Pebble Phosphate Export Associations. Official Weigher and Sampler for the National Cottonseed Products Association at Savannah; also Official Chemists for National Cottonseed Products Association.

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Phosphate Consultant

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Blood
Bone
All
Ammoniates

Jos. H. SCHMALTZ

BROKER
FERTILIZER MATERIALS

327 South La Salle Street CHICAGO

OFFICIAL BROKER FOR MILORGANITE

This Trade-Mark is a Monument to a Great Desert Victory

WEBSTER defines a trade-mark as a distinguishing mark or device...impressed on goods labels, etc., to distinguish them from others.

We define our P.C.A. Red Indian trade-mark as a symbol of protection for us as producers, for you as distributors, and for the army of farmers using our products to help produce larger and better food oil and fiber crops so essential to our fighting forces, our Allies, and to Victory.

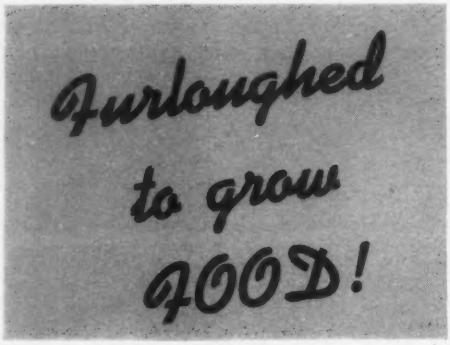
This trade-mark is a guarantee of uniformity. It stands for Potash of dependable quality. It symbolizes a policy of complete and whole-hearted co-operation with the fertilizer industry.

P.C.A. Red Indian is a safe symbol to tie to.

POTASH COMPANY OF AMERICA

CARLSBAD, NEW MEXICO

GENERAL SALES OFFICE...50 Broadway, New York, N. Y. • SOUTHERN SALES OFFICE...Mortgage Guarantee Building, Atlanta, Ga.



Barrett Nitrogen Solutions are back at the job for which they were developed during peacetime—the job of supplying Nitrate and Ammonia Nitrogen for American mixed fertilizers.

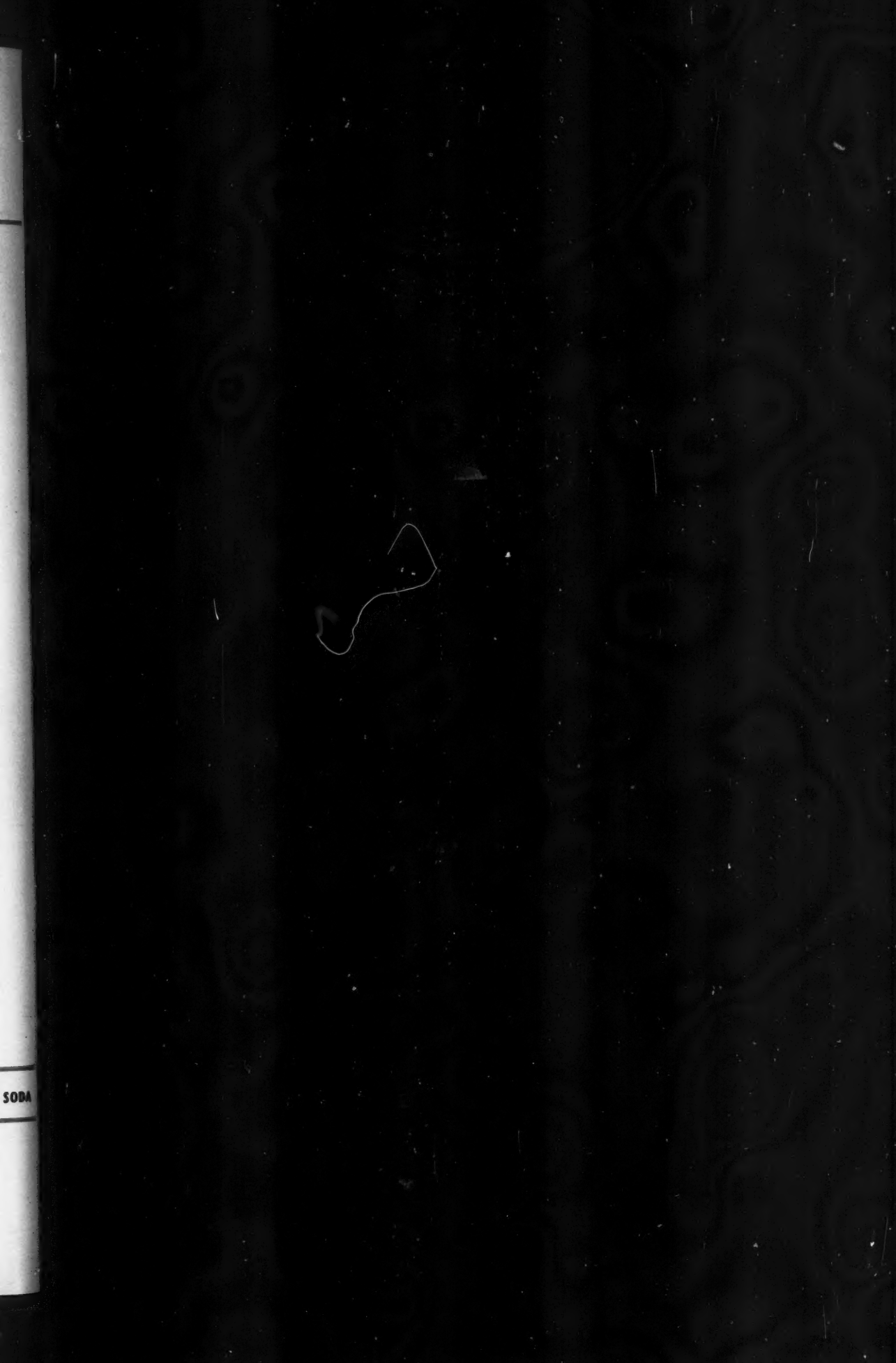
The distribution of these Solutions to the fertilizer industry was interrupted during critical early stages of the War, while the production capacity of the Hopewell plant rendered vital service to the fighting front.

When Pearl Harbor was attacked, Uncle Sam was suddenly confronted with the urgent and immediate need for Anhydrous Ammonia and Ammonium Nitrate for the manufacture of munitions. Diverting large quantities of these materials from use in Barrett Nitrogen Solutions helped to supply this need until government-built Nitrogen plants could be erected and brought into operation.

Today the Solution-Nitrogen production of the Hopewell plant is back in the service of the home front. Serving as an economical source of Nitrogen for mixed fertilizers, Barrett Nitrogen Solutions are helping to grow food to win the War and the Peace.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.
133 CARNEGIE WAY, ATLANTA 3, GA.

Barrett NITROGEN

HEADQUARTERS FOR AMERICAN-MADE NITROGEN

BARRETT NITROGEN SOLUTIONS ★ DOMESTIC SULPHATE AMMONIA ★ *ARCADIAN, THE AMERICAN NITRATE OF SODA
*REG. U. S. PAT. OFF.